

# (12) UK Patent Application (19) GB (11) 2 317 872 (13) A

(43) Date of A Publication 08.04.1998

(21) Application No 9620557.0

(22) Date of Filing 02.10.1996

(71) Applicant(s)

BT Rolatruc Limited

(Incorporated in the United Kingdom)

6 Kingsland Grange, Woolston, WARRINGTON,  
Cheshire, WA1 4RW, United Kingdom

(72) Inventor(s)

Peter Amos

(74) Agent and/or Address for Service

Potts, Kerr & Co

15 Hamilton Square, BIRKENHEAD, Merseyside,  
L41 6BR, United Kingdom

(51) INT CL<sup>6</sup>

B60S 5/06, B60K 1/04

(52) UK CL (Edition P)

B8E E20

B7H HA H626

B8H HSA H503 H510

(56) Documents Cited

EP 0620135 A2

US 0668109 A

US 4450400 A

US 3834563 A

(58) Field of Search

UK CL (Edition ) B7H HA, B8A AGA AGB AGC A4JL

A42, B8E E20

INT CL<sup>6</sup> B60K 1/04, B60S 5/06

Online: WPI

## (54) Vehicle battery changeover apparatus

(57) A battery changeover apparatus for a battery powered vehicle comprises a drive means provided on the vehicle and positioned adjacent the battery position. Whilst the drive means may comprise a hydraulic ram or a cable and pulley, the preferred arrangement consists of a chain drive 41 driven by a motorised drum 44 and running around a secondary drum 45. For removing the battery 1 from the vehicle a dog 42 on the chain is engageable with a projection 11 on the battery so that as the chain 41 is rotated the battery 1 is pushed off the vehicle. For mounting a battery on the vehicle the drive means preferably includes a flexible coupling 43 which is connected to a peg 2 on the battery so that upon rotation of the chain the battery is pulled onto the vehicle. Roller beds 21, 3 may be provided on the vehicle and at a battery receiving point these having a slight incline to cause the battery to roll off the vehicle. Further features include locking means for fixing the battery and sufficiently long leads to enable the vehicle to remain connected to the battery whilst it is being loaded or unloaded. The motorised drum 44 may be powered either by an electric or hydraulic motor.

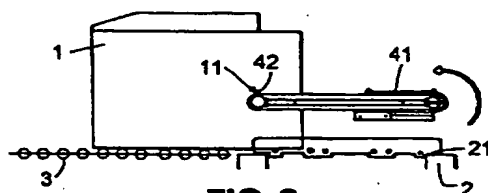


FIG. 3

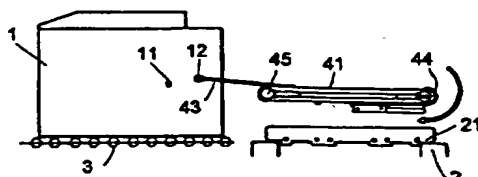


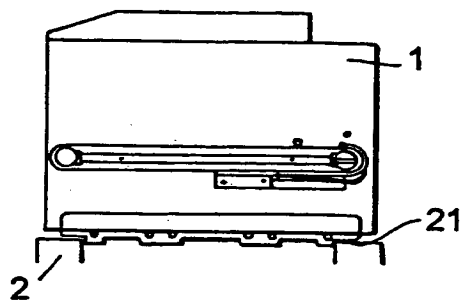
FIG. 6

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

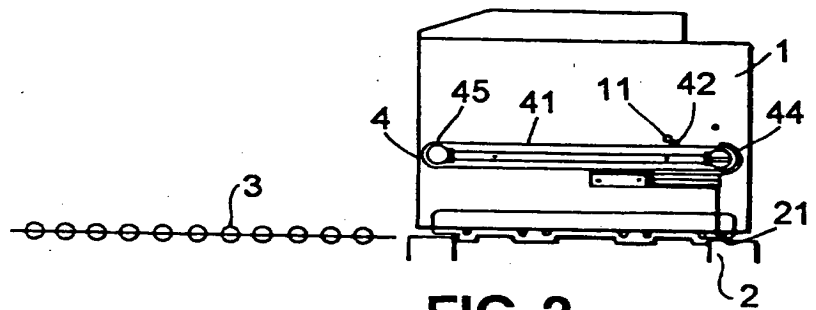
The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1995

GB 2 317 872 A

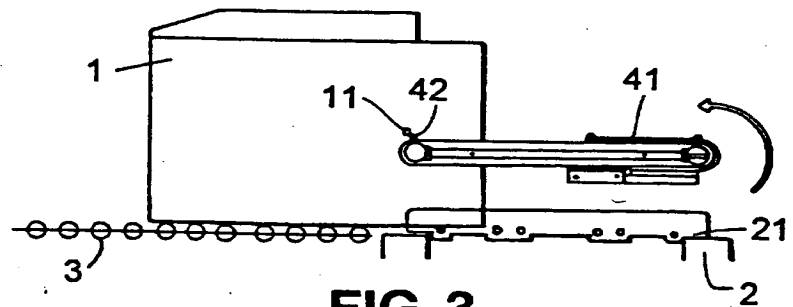
1/2



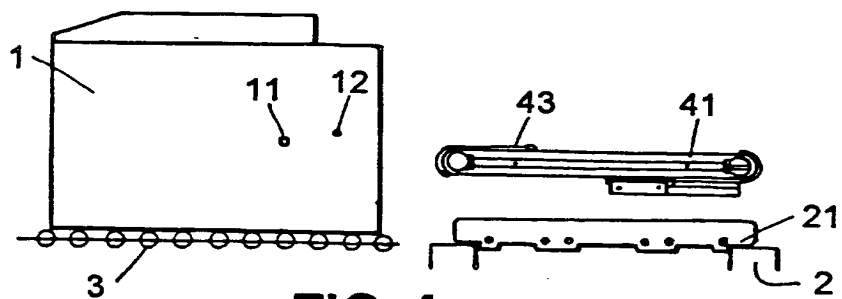
**FIG. 1**



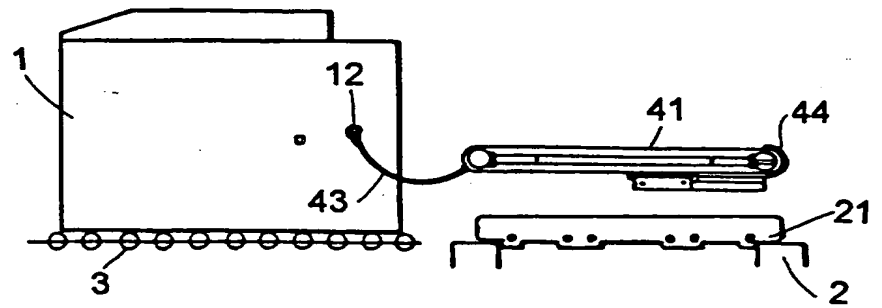
**FIG. 2**



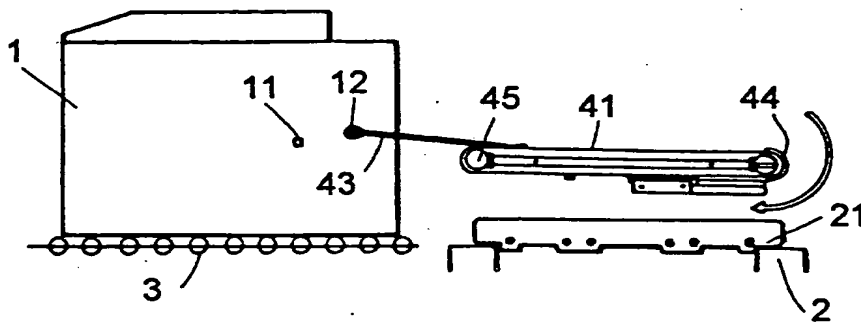
**FIG. 3**



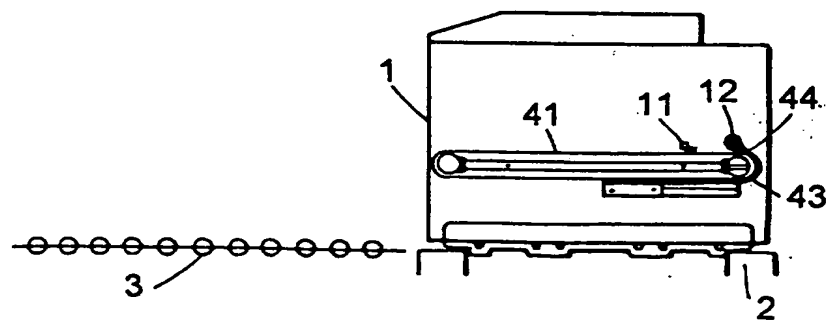
**FIG. 4**



**FIG. 5**



**FIG. 6**



**FIG. 7**

ELECTRIC VEHICLE BATTERY CHANGEOVER APPARATUS

The present invention concerns improvements in or relating to a battery changeover apparatus suitable for use with an electric vehicle.

Particular reference will be made herein to an electric powered materials handling vehicle, such as a powered pallet truck, stacker, or fork-lift truck, but the apparatus described is equally applicable to a wide range of vehicles, including road-going cars and delivery vehicles.

Materials handling vehicles require a relatively large and heavy battery in order to give an acceptable performance, range or work period from each battery charge. For example, a fork-lift truck may be designed to allow continuous use for periods of up to 8 hours handling heavy loads of up to 3000Kg. It is desirable to be able to remove an exhausted battery from the vehicle for charging and to load a new charged battery, in order to allow the vehicle to continue in use immediately. A problem arises in that a battery may weigh of the order of 1,000 Kg and cannot be moved manually by one person.

One known solution is to mount the battery on a roller bed on the truck so that the battery may be manually pushed off the truck on to an adjacent battery charging platform. However, moving the battery still involves a significant degree of manual effort which can sometimes induce back-strain related injuries.

An aim of the present invention is to provide a battery changeover apparatus which minimises physical effort required from an operator and minimises injury risk. It is a preferred aim to provide a battery changeover

apparatus which is compact, simple, and reliable.

According to the present invention there is provided a battery changeover apparatus for a materials handling vehicle, comprising:

horizontal drive means mountable on the vehicle for moving a battery off of and on to the vehicle; and

reach means for mechanically coupling said drive means to a battery outside the vehicle, such that said drive means can pull the battery on to the vehicle.

The battery may simply be loaded to and from the ground. Wheels or rollers may be provided on the battery or on the vehicle for easier movement of the battery. However, the battery changeover apparatus is particularly intended for use in conjunction with a battery receiving and charging platform. In use, the vehicle and platform are aligned to provide a substantially horizontal battery travel path. Preferably, a roller bed is provided on the platform and on the vehicle.

The drive means preferably comprises a drive element reciprocally movable along a substantially linear path or track, the drive element being coupled to move the battery. A hydraulic ram may be used to move the drive element, or cable winch with a pulley arrangement. In the preferred embodiment, the drive element is a chain drive, conveniently around a drum on a drive motor and a horizontally aligned secondary drum. An electric powered drive motor may be used, or conveniently a hydraulic motor coupled, for example, to existing vehicle hydraulics.

The chain drive may be coupled to the battery by any suitable means, including friction. Preferably, a projection on the chain drive engages a projection on one side of the battery. Driving the chain moves the battery over the roller bed and off of the vehicle.

For ease of use, it is undesirable to require precise alignment of the vehicle with a new battery to be loaded. The reach means is preferably a flexible coupling member such as a chain which is ideally connected to the chain drive and releasably coupled to the battery.

In the field of materials handling vehicles such as fork-lift trucks, it is desirable for the overall dimensions of the truck to be as compact as possible, in order to minimise turning circle and aisle widths. Conveniently, the drive motor may be mounted on a fork lift truck near to existing hydraulic systems, such as on the mast. The secondary drum can also be mounted on the mast, preferably so that the chain drive extends substantially the width of the truck.

In the preferred embodiment, one end of a reach chain is pivotably coupled to a link of the drive chain. The other end of the reach chain is used to reach outside the truck and is coupleable to a new battery. Rotating the drive chain gathers in the reach chain to lie against the drive chain and pull on the battery. The reach chain preferably follows the drive chain around at least one drum, to pull the battery on to the full extent of the drive chain and into a home position. The combination of drive chain and reach chain is simple, lightweight, inexpensive and reliable. Positioning on the mast allows the apparatus to be compact and take up minimal additional space on the truck.

A preferred embodiment of the invention will now be described with reference to the accompanying drawings in which Figures 1-7 show a changeover apparatus at various stages of operation.

Fig. 1 shows a battery 1 resting in a home position on a vehicle such as a fork-lift truck 2. For ease of

movement, the battery is mounted on a roller bed 21 and is slideable laterally across the truck. Locking means such as a catch or slide bolt are employed to lock the battery 1 securely in this home position during normal use of the truck.

Referring now to Fig. 2, to change the battery the truck 2 is first driven to rest adjacent a charging platform including a roller bed 3. In the prior art, the battery would have to be manually pushed from the truck on to the charging platform. The charging platform roller bed 3 is conveniently of substantially the same height as the truck roller bed 21, and may be adjustable to fit a variety of trucks. Also, the bed 3 is preferably inclined away from the truck 2 so that a battery tends to roll toward a safe position at the back of the platform.

A battery changeover apparatus 4 is provided on the truck 2. In this embodiment, a linear drive mechanism is provided in the form of a horizontally mounted chain or belt drive 41 which may conveniently be powered by a hydraulic motor running off the hydraulic power system of the truck 2. The chain drive 41 runs around a drum 44 on the motor and a secondary drum 45.

To begin unloading of the exhausted battery, the locking means is released. An interlock may be provided to limit movement of the truck to a crawl speed when so released.

As shown in Fig. 2, drive chain 41 rotates in a first direction until an engagement mechanism such as a dog 42 engages a receiving means on the battery such as a block 11. To maintain power to the truck, the battery may remain electrically connected during unloading by an extendible flying lead (not shown).

Block 11 may be located at any suitable position on the battery, but is conveniently provided on one side of the battery 1. Surprisingly, it has been found that only one linear drive mechanism need be provided, which can act against one side of the battery without significant twisting moment.

The chain drive 41 is now driven to push the battery 1 across roller bed 21 to reach the position shown in Fig. 3. The length of chain drive 41 is preferably selected to be within the width of the truck 2, since overhang would undesirably increase truck dimensions. A slight downward incline may be provided at the edge of roller bed 21. Gravity, and momentum in the battery 1, combine to carry the battery completely on to the platform roller bed 3 and the position shown in Fig. 4. The dog 42 merely abuts the block 11 on the battery 1, so the battery readily moves away from the dog 42. The platform is provided with battery catch means to absorb impact and prevent excessive rollback.

To load a new battery, the truck is slowly driven until the roller bed 21 is adjacent a new battery 1 on the or an adjacent platform 3. Electrical connection may now be swapped to the new battery and the exhausted battery connected to a charging apparatus.

For ease of operation, it is desirable to allow a high degree of error in aligning the truck with the new battery. This is achieved by the use of reach means to reach outside the truck and couple the battery 1 to the linear drive mechanism. As shown in Figs. 4 and 5, a pull chain 43 is ideally provided pivotably mounted to the chain drive 41 and coupleable to a receiving peg 12 on the battery 1. Pull chain 43 may take any suitable form such as a chain, wire, rope, tape or even a solid bar member. The length of pull chain is selected to prevent the



changeover apparatus being used when the truck 2 is so far away from the roller bed 3 that battery 1 may fall therebetween.

Referring now to Fig. 6, the chain drive 41 is rotated in a reverse direction to take in any slack in pull chain 43 and then pull the battery 1 toward the truck. In an alternate embodiment, drive chain 41 is driven round in only one direction. Tension in the pull chain 43 is maintained by the slight incline in roller beds 3 and 21.

As shown in Fig. 7, drive chain 41 rotates until the new battery 1 reaches the home position on truck 2. Conveniently, the pull chain 43 follows the drive chain 41 around the drum 44 to increase the effective travel path. Once in the home position, the pull chain 43 is removed from the battery 1 and may be stowed away. The locking means are engaged to hold the battery in the home position and allow the truck to return to normal operation.

The battery changeover apparatus described has a number of advantages in that it is compact, simple, requires few components, is inexpensive to manufacture and install, may be retro-fitted to existing vehicles, and requires only minimal space in the vehicle.

---

CLAIMS

1. A battery changeover apparatus for a materials handling vehicle, comprising:

horizontal drive means mountable on the vehicle for enabling displacement of the battery to move such off or on to the vehicle; and

coupling means for enabling coupling of said drive means to a battery to be loaded, to enable said drive means to pull the battery onto the vehicle.

2. A battery changeover apparatus as claimed in claim 1, in which a roller bed is provided on the vehicle for enabling ease of movement of the battery on to or off the vehicle.

3. A battery changeover apparatus as claimed in claim 1 and 2, in which said drive means comprises a drive element reciprocally moveable along a substantially linear path or track.

4. A battery changeover apparatus as claimed in claim 3, in which said drive element comprises a hydraulic piston and cylinder arrangement.

5. An apparatus as claimed in claim 3, in which said drive element comprises a belt or chain drive.

6. An apparatus as claimed in claim 5, in which said belt or chain drive is an endless belt or chain drive.

7. An apparatus as claimed in any preceding claim, in which said drive means is powered by an electric drive motor.

8. An apparatus as claimed in any of claims 1 - 6, in which said drive means is powered by a hydraulic motor coupled to the vehicle hydraulic system.

9. An apparatus as claimed in any preceding claim, in which said drive means engages a projection provided on one side of the battery, which is engageable with means provided on the drive means for displacement of the battery off the vehicle.

10. An apparatus as claimed in any preceding claim, in which said coupling means comprises a flexible coupling attached to the drive means and which is detachably engageable

to the battery to enable the battery to be pulled onto a vehicle.

11. A method of mounting and dismounting a battery on a vehicle, comprising:

positioning a battery to be mounted adjacent to a vehicle for receiving such, attaching a coupling to said battery, said coupling being attached to a drive means provided on the vehicle, actuating said drive means to pull the battery onto said vehicle, detaching said drive means and applying locking means to secure the battery in position and subsequently for dismounting the battery, releasing said locking means, actuating said drive means to push the battery off the vehicle.

12. A battery changeover apparatus for a materials handling vehicle, substantially as hereinbefore described with reference to the accompanying drawings.



The  
Patent  
Office

10

Application No: GB 9620557.0  
Claims searched: 1-10 & 12

Examiner: Matt Jefferson  
Date of search: 13 January 1998

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK Cl (Ed.P): B7H (HA); B8A (AGA, AGB, AGC, A42, A4JL); B8E (E20).

Int Cl (Ed.6): B60K 1/04; B60S 5/06

Other: Online: WPI.

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0620135 (GOTTLOB AUWAERTER) See abstract and figures.	1, 2, 8.
A	US 4450400 (GWYN) See abstract and figure 1.	1.
X	US 3834563 (TETI) See whole document.	1, 3, 4, 8, 9.
X	US 668109 (MAILLOUX) See page 2, lines 55-87 and figures 6, 11 and 13	1, 3, 5, 6, 7, 9.

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
E Patent document published on or after, but with priority date earlier than, the filing date of this application.

**THIS PAGE BLANK (USPTO)**